

LA-UR-18-31164

Approved for public release; distribution is unlimited.

Title: Environmental Report Summary 2017

Author(s): Townsend, Cameron Dee; Echave, Carina Michelle; Jones, Emilee Rae; Rybarcyk, Emily Marie; Musgrave, Karen Suzanne; Gallegos, Kylie Marie; Quintana, Makenzie Louise; Musgrave, Maria A.; Bulthuis, Sara Elise; Sweeney, Sierra Rebecca; Ashford, Sydne Fe; Lovato, Victoria Maria Ester

Intended for: Report

Issued: 2019-01-23 (rev.1)

Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Environmental **REPORTSUMMARY**

2017



LOS ALAMOS NATIONAL LABORATORY

delivers science and technology that promote world stability while remaining a good steward of the environment. The Laboratory's mission is to solve national security challenges through scientific excellence. Inseparable from the Lab's commitment to excellence in science and technology is its commitment to environmental stewardship and full compliance with environmental regulations.

WHAT ARE THE LABORATORY'S GOALS?

- Deliver national nuclear security and broader global security mission solutions.
- Foster excellence in science and engineering disciplines essential for national security missions by
 - attracting, inspiring, and developing world-class talent to ensure a vital future workforce, and
 - enabling mission delivery through next-generation facilities, infrastructure, and operational excellence.

COMMITMENT TO ENVIRONMENTAL STEWARDSHIP

Los Alamos is committed not only to excellence in science and technology but also to completing all work in an environmentally responsible manner. Every year, the Laboratory produces an Annual Site Environmental Report (ASER) in compliance with U.S. Department of Energy (DOE) Order 231.1B–Environment, Safety, and Health Reporting. For the full ASER text, see Los Alamos National Laboratory document LA-UR-18-28565.

Through the ASER, the Laboratory communicates to the public the impacts its operations might have on the surrounding environment and the approaches used to mitigate these impacts.

This *Environmental Report Summary* magazine, produced primarily by Laboratory students, provides a nontechnical overview of the ASER and highlights many of the Laboratory's environmental programs. The *Environmental Report Summary* recognizes efforts to create a sustainable future, control present processes to minimize impacts, and clean up past releases of chemicals, including radionuclides, to the environment.

This publication summarizes data and findings from 2017, which was published in 2018. Comments are welcome at envoutreach@lanl.gov.

LA-UR-18-31164

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is managed by Triad National Security, LLC, for the National Nuclear Security Administration of the U.S. Department of Energy under contract 89233218CNA000001.

Contents

Long-Term Strategy.....1

Compliance at a Glance.....3

Shipping restarted to the Waste Isolation Pilot Plant.....5

The Laboratory's new Transuranic Waste Facility.....6

Environmental projects to fulfill settlement agreement with NMED.....7

Laboratory well below Title V air quality permit limits.....8

Ensuring environmental compliance through the National Environmental Policy Act.....9

Environmental Protection.....11

Laboratory upgrades Environmental Management System certification.....12

Identifying opportunities for source reduction at the Laboratory.....13

Improving Lab infrastructure increases site-wide efficiency in a sustainable way.....14

A cleaner, more sustainable workplace.....15

Preserving yesterday for tomorrow.....16



Monitoring endangered and threatened species.....	18
Air Quality.....	20
Laboratory meets all air quality compliance requirements.....	21
Little rain, lots of shine: Recording meteorological data in Los Alamos County.....	23
Water Monitoring.....	24
What is groundwater?.....	25
Protecting watershed and surface water quality.....	26
Ecosystem Health.....	28
Studying the local wildlife for conservation.....	29
Working to ensure a healthy aquatic ecosystem.....	31
Radiation Protection.....	32
Monitoring ionizing radiation to determine the maximally exposed individual.....	33
Contributors.....	35



Long-Term Strategy

In 2013, the Laboratory developed a long-term strategy for environmental stewardship and sustainability. This strategy identified seven environmental "grand challenges" to provide guiding principles for the Laboratory's environmental stewardship.

Clean the
PAST

Control the
PRESENT

Create a sustainable
FUTURE

Grand Challenge 2:

Remove or stabilize pollutants from the Manhattan Project and Cold War eras.

Grand Challenge 1:

Collaborate with our stakeholders and tribal governments to ensure that LANL's impact on the environment is as low as reasonably achievable.

Grand Challenge 3:

Protect water resource quality and reduce water use.

Grand Challenge 4:

Eliminate industrial emissions, discharges, and releases to the environment.

Grand Challenge 5:

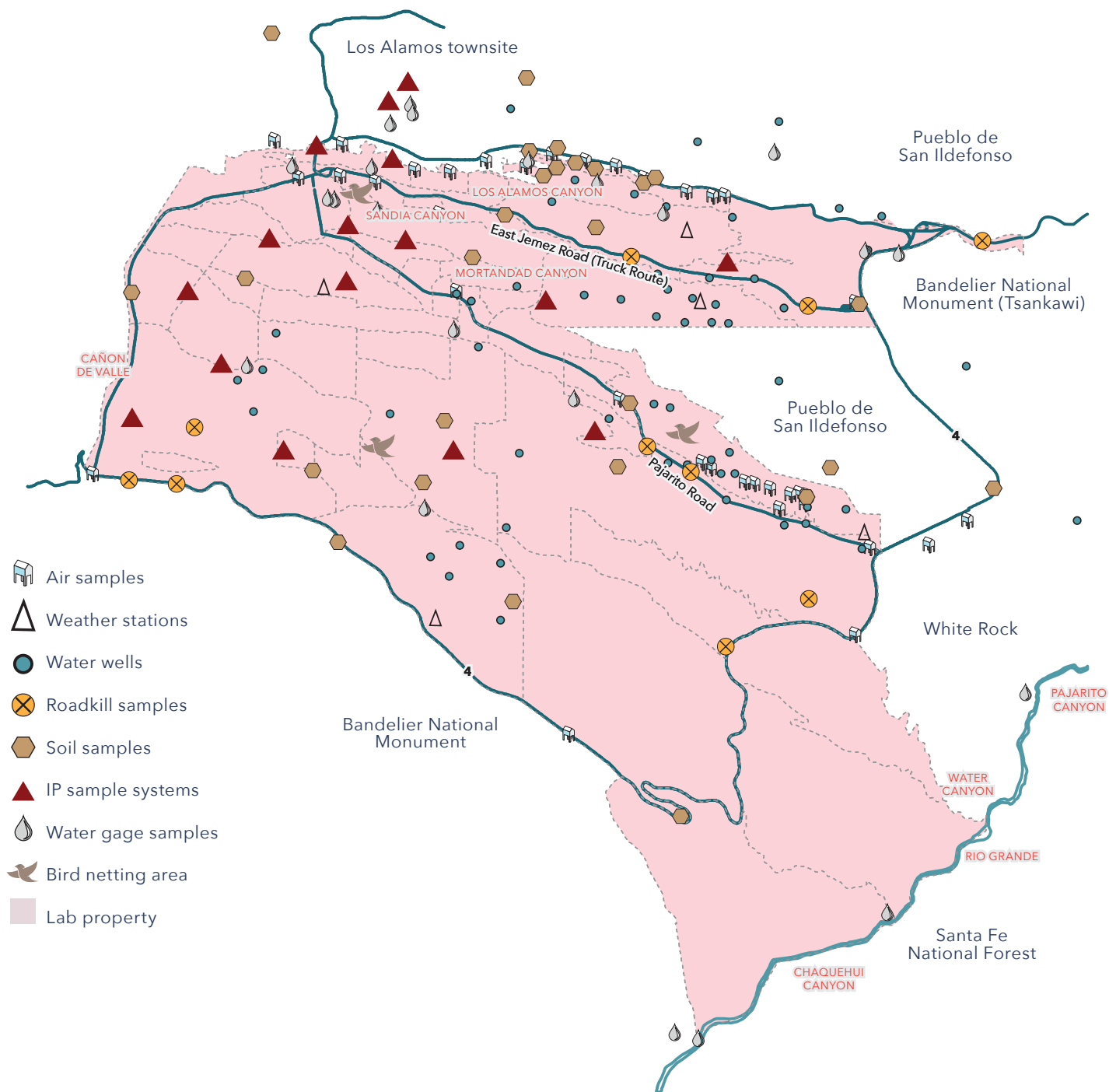
Protect human and environmental health by managing and restoring lands.

Grand Challenge 6:

Produce zero radioactive, hazardous, liquid, or solid wastes.

Grand Challenge 7:

Use energy efficiently while creating sustainable energy resources.



How does the Laboratory work to achieve environmental stewardship and sustainability?

This year, 2018, Los Alamos National Laboratory is celebrating its 75th anniversary. The mission of the Laboratory at its founding was to protect the nation through innovative science. Today, the Laboratory's mission is to solve national security challenges through scientific excellence. Excellence in operations includes fully complying with environmental regulations and sustainably operating the Laboratory to allow it to serve the nation for as long as needed.

Today we use the grand challenges to help select the annual institutional targets for the Laboratory's environmental management system. The environmental management system guides the Laboratory's actions to achieve a sustainable present and future.

For more information, read Chapter 3 of the 2017 Annual Site Environmental Report (ASER), Los Alamos National Laboratory document LA-UR-18-28565.

2017 Compliance at a glance

ENVIRONMENTAL PROTECTION

DOE ORDER 231.1B - ENVIRONMENT, SAFETY, AND HEALTH REPORTING

Requires the collection and reporting of information on events or conditions that could adversely affect public or environmental health

EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT

Requires there be plans for hazardous substances that may be present on Laboratory property and that local emergency planning committees be notified when there is a leak or spill; requires an annual inventory featuring the quantity and location of all facility hazardous chemicals

FEDERAL FACILITY COMPLIANCE ACT

Regulates mixed wastes (radioactive and hazardous)

NATIONAL ENVIRONMENTAL POLICY ACT

Requires federal agencies, including DOE, to consider the environmental impact of their activities and operations during decision making

- In 2017, approximately 1,112 projects were reviewed for compliance with NEPA.

RESOURCE CONSERVATION AND RECOVERY ACT

Regulates hazardous wastes from generation to disposal; mandates a hazardous waste facility permit

- Eight violations identified by the New Mexico Environment Department in April 2017 were resolved and closed out by December.
- In 2017, the Laboratory worked with the New Mexico Environment Department to establish 20 sampling and monitoring locations for a surface water sampling project as part of a settlement agreement for earlier violations under the Act.
- Solid non-hazardous waste that was sent offsite totaled 3,278,509 kilograms in 2017.

TOXIC SUBSTANCES CONTROL ACT

Addresses the production, use, and disposal of specific chemicals, including PCBs

- During 2017, the Laboratory shipped 46 containers, roughly 3,305 kilograms, of PCB waste to an offsite treatment and disposal facility.

2016 COMPLIANCE ORDER ON CONSENT

Provides a process for remediation of solid waste management units (locations where solid or hazardous wastes have been stored or where wastes were released)

- There were 1,403 solid waste management units remaining to be remediated during 2017, 76 of which were completed with controls, 229 without controls, 135 were deferred, and 963 are still pending.

AIR QUALITY

CLEAN AIR ACT - TITLE V OPERATING PERMIT

Requires that all air emissions of regulated pollutants remain below the permit limits

CLEAN AIR ACT - TITLE VI REFRIGERANTS AND HALONS

Regulates any ozone-depleting chemicals, like halons, during maintenance, repair, and disposal of equipment and systems

NEW MEXICO AIR QUALITY CONTROL ACT

Requires the evaluation of new or modified sources of Laboratory air emissions

WATER

CLEAN WATER ACT

Requires National Pollutant Discharge Elimination System permits for several types of effluent and storm water discharges; the Act also has requirements for aboveground storage tanks

- In 2017, none of the 919 samples collected from the Laboratory's industrial outfalls exceeded the limits in our outfall permit.

THE ENERGY INDEPENDENCE AND SECURITY ACT

Establishes storm water runoff requirements for federal development projects

NEW MEXICO WATER QUALITY ACT

1. Establishes water quality goals for state surface waters by designating uses and setting standards

2. Establishes maximum allowable concentrations of specified contaminants in groundwater

3. Regulates the liquid discharges above and below ground surfaces to protect groundwater

2016 COMPLIANCE ORDER ON CONSENT - GROUNDWATER ACTIVITIES

Provides a process for remediation of groundwater contaminant plumes

- Under the Consent Order with the New Mexico Environment Department, the Laboratory performed groundwater protection activities in 2017 including inspections, investigations, and reports.

ECOSYSTEM HEALTH

ENDANGERED SPECIES ACT

Requires agencies to protect federally listed threatened and endangered species and their habitats

FLOODPLAIN AND WETLAND EXECUTIVE ORDERS

Under Executive Orders 11988 and 11990, impacts to floodplains and wetlands are assessed in the event of a project on or near any floodplains or wetlands

FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT

Regulates using, selling, and distributing all pesticides. Laws restricting pesticide use are enforced by the New Mexico Department of Agriculture under the New Mexico Pesticide Control Act

MIGRATORY BIRD TREATY ACT

Makes it unlawful to harm any migratory bird, including active nests, except as permitted by regulation

RADIATION PROTECTION

DOE ORDER 435.1 CHG 1 - RADIOACTIVE WASTE MANAGEMENT

Regulates storage and disposal of radioactive wastes

- The Waste Isolation Pilot Plant resumed receiving transuranic waste in 2017 from the Laboratory after a closure in 2014.
- In 2017, 5,058,687 kilograms of low-level waste were sent offsite for disposal.

DOE ORDER 458.1 - RADIATION PROTECTION OF THE PUBLIC AND THE ENVIRONMENT

Establishes limits for radiological releases from DOE facilities

- In 2017, the maximum public radiological dose was less than 1 millirem. The doses for animal and plant life were also well below the minimum requirement.
- Approximately 50,000 pounds of metal were released for recycling by the Laboratory in 2017, and there were no traces of above-background radioactivity.

ADDITIONAL INFORMATION

TRANSURANIC WASTE IS...

Waste containing transuranic radionuclides that emit activity greater than 100 nanocuries per gram of waste

LOW-LEVEL WASTE IS...

Waste with added radioactivity, but no materials considered hazardous according to the Resource Conservation and Recovery Act

MIXED WASTE IS...

Radioactive waste combined with waste that is hazardous according to the Resource Conservation and Recovery Act

ENDANGERED AND THREATENED SPECIES AT OR NEAR THE LABORATORY

Jemez Mountains salamander, Mexican spotted owl, New Mexico meadow jumping mouse, Southwestern willow flycatcher, and yellow-billed cuckoo

NATIONAL HISTORIC PRESERVATION ACT

Requires agencies to consider the impact their operations and activities may have on historic properties, such as archaeological sites or historic buildings

- In 2017, updates to A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico (Revision 3) at the Laboratory were approved by the State Historic Preservation Office, the Advisory Council on Historic Preservation, and DOE.

Shipping restarted to the Waste Isolation Pilot Plant

Laboratory transuranic waste drums were treated and shipped to WIPP for permanent storage.

BY CARINA ECHAVE In 2017, the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, began accepting transuranic (TRU) waste again, and the Laboratory delivered a TRU waste shipment to WIPP for the first time since 2014.

In February 2014, an exothermic reaction occurred in a drum of nitrate salt-bearing TRU waste shipped from the Laboratory to WIPP. As a result, all shipments to WIPP were stopped, and WIPP had to ensure the contamination was cleaned up. The accident investigation determined that the nitrate salt-bearing waste had been improperly treated with an organic absorbent. Using an organic treatment caused a series of chemical reactions that led to an over-pressurization of the waste drum and the release of radioactive contamination.

"With the freeze of shipment to WIPP, there had been nowhere for TRU waste from Technical Area 55 to go. Technical Area 55 was running out of space for radioactive waste drums and they were close to their Material at Risk limit," explains Christine Bullock, a Laboratory Environment, Safety, and Health professional.

In 2017, in response to the contamination release, the Laboratory began treating all its nitrate salt-bearing waste drums using zeolite and water. This process removes the hazardous constituents that led to the chemical reaction and release.

In tandem with Laboratory work, WIPP completed corrective actions and readiness reviews, including requiring details of waste barrel contents received. WIPP reopened for waste deliveries in spring 2017. In November 2017, the Laboratory delivered its first new shipment of TRU waste to WIPP. Bullock adds, "What the November shipping resumption meant for the Lab was that Technical Area 55 would not have to curtail its Laboratory mission."

For more information, read Chapter 2 in the 2017 ASER.

Packaging TRU waste at the Laboratory for shipment to WIPP in November 2017.



WHAT IS TRU WASTE?

"Transuranic" means "beyond uranium" and refers to elements that have a larger atomic number than uranium, such as plutonium. Transuranic waste is one of the four types of radioactive waste made by the Laboratory: mixed low-level waste, low-level waste, mixed transuranic waste, and transuranic (TRU) waste. Since TRU waste is radioactive, it must be stored in specific drums under a dome for protection and disposed of in a facility meant for radioactive waste, such as WIPP.

The Laboratory's new Transuranic Waste Facility

The Transuranic Waste Facility enables the Laboratory to safely store and then ship transuranic waste to WIPP.

BY CARINA ECHAVE Los Alamos National Laboratory produces transuranic (TRU) waste as a byproduct of its routine work. The new Transuranic Waste Facility (TWF), which opened in 2017, was built to store the Laboratory's TRU waste drums before they are shipped to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. TWF provides a safe holding location for radioactive TRU waste at Los Alamos, until the Laboratory can then ship that waste to WIPP.

TWF completed formal readiness reviews and received permission to begin operating in September 2017. In October, TWF received its first TRU waste shipment from Technical Area 55.

Located within Laboratory property, TWF comprises eight buildings for characterizing and storing TRU waste. TWF can store 825 waste drums on a regular basis and up to 1,240 waste drums, if needed, per storage building.

TWF buildings are designed to withstand several accident scenarios, including severe weather, fire, and earthquakes, in accordance with Department of Energy nuclear safety regulations. Christine Bullock, the TWF start-up lead in Environment, Safety, and Health, adds, "The engineering and administrative controls at TWF ensure that there is no offsite [radiation] dose from routine operations." TWF is included in the Laboratory's hazardous waste facility permit from the New Mexico Environment Department.

TWF is authorized to certify TRU waste for shipment to WIPP. Shipping TRU waste out of Los Alamos allows the Laboratory to continue its work without exceeding its TRU waste storage capacity. WIPP was built for underground permanent storage of TRU waste, which minimizes radiation exposure to the public and environment.

For more information, read Chapter 2 in the 2017 ASER.



TWF has two buildings for characterization of TRU waste and six buildings for TRU waste storage.

Environmental projects to fulfill settlement agreement with NMED

Work on five environmental protection projects began in 2017.

BY CAMERON TOWNSEND The Laboratory entered into a settlement agreement with the New Mexico Environment Department (NMED) in 2016 to address improper treatment of transuranic waste shipped from the Laboratory to the Waste Isolation Pilot Plant in Carlsbad, New Mexico. The terms of the settlement agreement included the undertaking of five environmental protection projects. These projects will help ensure proper stewardship of precious natural resources and should be implemented by 2019. Below are descriptions of the five projects and updates on progress in 2017 and 2018.



ROADS PROJECT

Goal: Improve routes used for the transportation of transuranic waste to the Waste Isolation Pilot Plant.

Status Update: The U.S. Army Corps of Engineers managed design and construction activities. Construction began in June 2018 and was completed in September.



TRIENNIAL REVIEW

Goal: Conduct an independent, external triennial review of environmental regulatory compliance and operations.

Status Update: A third-party auditor was identified to conduct the review. The first review was conducted in March 2018.



WATERSHED ENHANCEMENT

Goal: Improve local water quality by slowing storm water flow and decreasing sediment load.

Status Update: A low-impact development master plan was created in 2017. Construction is ongoing as of August 2018.



SURFACE WATER SAMPLING

Goal: Increase sampling and monitoring of storm water runoff in and around the Laboratory and share the results with the public and NMED.

Status Update: In early 2017, over 30 sites were established for sample collection. Most sample collection will be completed by the beginning of November 2018.



POTABLE WATER LINE REPLACEMENT

Goal: Replace aging potable water lines and install metering equipment for Laboratory potable water systems.

Status Update: Wilson and Co. completed the design for the new lines and meters in 2017. The design was submitted to NMED for review and approval in January 2018. Construction began in fall 2018.



Laboratory well below Title V air quality permit limits

Ensuring the Laboratory meets compliance requirements for air emissions was a breeze, thanks to the efforts of the air quality team.

BY SARA BULTHUIS In 1990, the United States Environmental Protection Agency passed the Title V amendment to the Clean Air Act, effectively bringing all air quality compliance requirements under one enforceable permit. As a major source of regulated air pollutants, the Laboratory has been operating under a Title V Operating Permit, issued by the New Mexico Environment Department, Air Quality Bureau, since 2003.

Each year, the Laboratory certifies its compliance with the Title V Operating Permit and reports any permit deviations to the New Mexico Environment Department. If the Laboratory exceeds permit limits, the Laboratory could face serious penalties.

In 2017, as in previous years, the Laboratory's emissions were significantly lower than permit limits. The New Mexico Environment Department conducts annual inspections of the Laboratory to ensure all Title V Operating Permit conditions are met. To date, there have been no identifiable issues.

The Laboratory's Air Quality Monitoring Team continues to monitor emissions with the goal of continuing to stay well below permit limits.

For more information, read Chapter 2 in the 2017 ASER.

Ensuring environmental compliance through the National Environmental Policy Act

Environmental Stewardship staff reviewed over 1,000 Laboratory activities for environmental impacts.

BY KAREN MUSGRAVE Questions and answers with David Holtkamp, NEPA subject matter expert.

What is the National Environmental Policy Act (NEPA) and why did it become a law?

During the 1960s and '70s, a series of federal environmental regulations, including NEPA, were passed. NEPA addresses concerns for air quality, water quality, endangered species, important cultural sites, and environmental justice. Many environmental regulations have a single or limited focus based on subject, location, and time frame. NEPA serves as a "big-picture" tool where analyses from specific environmental factors are brought together to assess whether a project will have significant impacts immediately or into the foreseeable future.

What types of projects and activities do you review for NEPA at the Laboratory?

The Laboratory is under a federal agency, the Department of Energy (DOE), and all major federal actions are subject to NEPA. This means we review many actions that range from routine activities like road improvements and equipment replacement to unique capabilities at Los Alamos, such as the Weapons Program.

When you review a project for NEPA compliance, how do you approve it?

The Laboratory's primary NEPA coverage for mission activities is the Site-wide Environmental Impact Statement, or SWEIS. This document is one of several environmental impact statements and environmental assessments that previously analyzed activities and ongoing programs at the Laboratory for environmental impacts. Sometimes, additional environmental impact analyses are required before DOE determines that NEPA compliance has been achieved. Additional analyses may be in the form of an environmental assessment or a supplement analysis to an existing document.

How many projects do you typically review in a year?

We typically review about 1,000 projects a year. In 2017, we reviewed 1,112 projects for environmental impacts and NEPA compliance.

Did any project require additional evaluation for NEPA compliance in 2017?

One big project that required additional NEPA evaluation in 2017 was a DOE proposal to drill additional wells at the Laboratory to improve the effectiveness of the current control system for chromium plume migration in the groundwater. NEPA staff prepared a supplement analysis and DOE determined the environmental impacts of the proposed actions were bounded by analysis presented in the 2015 Environmental Assessment Chromium Plume Control Interim Measure and Plume-Center Characterization.

What is your favorite aspect of NEPA at LANL?

NEPA provides three important components of environmental compliance: transparency, planning, and public involvement. We have many clients and partnerships both within the Laboratory and in surrounding communities. NEPA is a way for voices to be heard and ensure that the DOE/NNSA has the right information to make well-informed decisions.

For more information, read Chapter 2 in the 2017 ASER.

ENVIRONMENTAL

Protection



Laboratory upgrades Environmental Management System certification

BY SYDNE ASHFORD The Laboratory's Environmental Management System (EMS) provides organizational structure that protects the environment from potentially harmful effects of Laboratory actions and advances the Laboratory's environmental stewardship. In 2017, the Laboratory successfully transitioned its certification to the newer International Organization for Standardization's 14001 standard (ISO 14001:2015). External audits and internal assessments are completed each year to maintain the Laboratory's ISO 14001 certification for its EMS.

The Environmental Management System holds the Lab to excellent environmental protection standards.

The EMS is organized through the following process:

1. Institutional objectives and targets are established by the Environmental Senior Management Steering Committee.
2. Once these objectives and targets are established, each Laboratory directorate considers how its work activities impact the environment.
3. Each directorate creates an Environmental Action Plan that addresses institutional objectives and targets within its work scope.
4. The directorate completes the Environmental Action Plan by taking actions and reviewing those actions every few months.

This organizational process is controlled through use of an EMS Toolkit. Available on the Laboratory's network, the EMS Toolkit displays each directorate's Environmental Action Plan and actions taken to complete it.

The EMS program looks forward to continuing its efforts in advancing the Laboratory's environmental performance through the involvement of senior leadership and emphasis on continuous improvement. By connecting environmental protection and improvement from senior management to all worker levels, the EMS improves site-wide environmental compliance.

For more information, read Chapter 3 in the 2017 ASER.



Identifying opportunities for source reduction at the Laboratory

Preventing pollution improves worker health and safety, reduces negative environmental impacts, improves LANL efficiency, and has a positive return on financial investment.

BY SYDNE ASHFORD The goal of the Laboratory's Pollution Prevention (P2) team is to reduce or eliminate waste, emissions, and effluent discharge whenever possible. Successful pollution prevention improves worker health and safety, reduces negative environmental and social impacts, improves the efficiency and effectiveness of LANL operations, and has a positive return on financial investment. The P2 team looks to fund innovative projects that offer significant opportunities for source reduction—the elimination of waste before it is created.

"The Pollution Prevention-funded efforts in 2017 are very exciting in that they not only prioritize source reduction for the overall benefit of the environment, but also the innovative technologies developed by these talented engineers and scientists can improve productivity and worker safety," explains Kassidy Burnett Boorman, P2 Program Lead. "This is not only a win for the Pollution Prevention program but also for our institution!"

For example, P2 has supported Green Chemistry projects working to eliminate hydrofluoric acid (a highly toxic and dangerous chemical) in nuclear forensic studies. Green Chemistry not only achieves source reduction of hazardous chemicals but also eliminates mixed radioactive waste from the waste stream and reduces risks to workers' health and safety.

The Laboratory's pollution prevention program aims to reduce pollutants of all types at their source during the design stage whenever possible. Methods and outcomes include

- sustainable procurement,
- intrinsically safe materials use,
- reductions in discharges to air, water, and waste, and
- reductions in materials use, including water and energy.

In the fiscal year 2017, pollution prevention projects saved the Lab an estimated \$4.5 million through the following activities:

- Recycling more than 615 tons of mixed paper, cardboard, plastic bottles, and cans
- Recycling more than 970 tons of metals and more than 2420 pounds of batteries
- Installing energy-efficient light-emitting diodes (LEDs) to replace outdoor uses of high-pressure sodium vapor lamps and mercury vapor lamps
- Eliminating offsite shipments of Sanitary Waste Water System sludge through composting and onsite use
- Reducing releases of sulfur hexafluoride (an extremely potent greenhouse gas) by supporting the development of sulfur hexafluoride-alternative technologies

For more information, read Chapter 3 of the 2017 ASER.

Improving Lab infrastructure increases site-wide efficiency in a sustainable way

The Laboratory's Site Sustainability program supports performance and future mission work by increasing operational efficiency and reducing energy consumption.

BY SYDNE ASHFORD The Laboratory's Sustainability Program endeavors to secure future mission work, replace aging infrastructure, and meet a growing demand for electricity. In 2017, Los Alamos National Laboratory continued to take actions to implement sustainable solutions as part of doing business and focused on making changes driven by deep analysis and new technology.

"The Sustainability Program continues to support the Laboratory and its mission by implementing initiatives like the Smart Labs program to improve operational capabilities, incorporate technological upgrades, and strategically manage our energy consumption," explains Monica Witt, the Laboratory's Site Sustainability Manager.

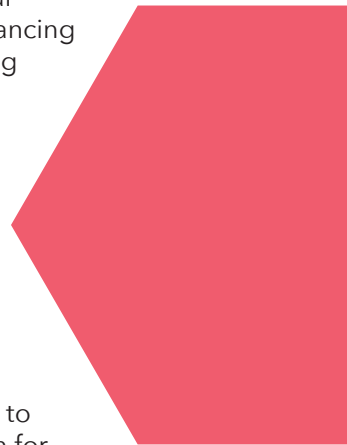
The Sustainability Program manages and implements goals set by the Department of Energy Sustainability Plan, as well as goals set by presidential executive orders. *These objectives include improving operations to maximize sustainable energy and water use, improving performance of existing facilities, preventing pollution, planning for climate resiliency, and planning for net-zero energy, water, and waste in facilities.*

In 2017, Laboratory actions promoted sustainability goals throughout the Laboratory, which included upgrading building automation systems to digital control in three facilities, thereby advancing the buildings' productivity; completing recommissioning efforts in five facilities, which allows for the efficient use of Laboratory facilities; and implementing SkySpark software in six additional buildings to maintain energy savings. Additionally, 27 million gallons of reclaimed wastewater were reused in computer cooling towers.

The Sustainability Program is working to implement a new Smart Labs Program for improved safety and energy efficiency in Lab space by installing continuous monitoring and control systems.

Although the Laboratory did not reduce energy intensity (energy use per square footage of a building), this year, the Lab did emphasize the Smart Labs Program, building automation systems, and recommissioning programs. These efforts will drive the Laboratory to meet its greenhouse gas emission reduction goals by fiscal year 2025. New missions coming to the Laboratory will increase water and energy use in the future, and meeting reduction goals will remain a challenge.

For more information, read Chapter 3 in the 2017 ASER.





Before and after the Mercury Road Cleanup Project.

A cleaner, more sustainable workplace

Equipment and materials from past projects were removed, recycled, or reorganized in 2017.

BY MARIA MUSGRAVE Prior to the initiation of the Site Cleanup and Workplace Stewardship Program at the Laboratory in 2014, there were no formal procedures for how to dispose of materials and equipment after a project or program ended. As a result, many legacy cleanup jobs needed attention, and a program to improve procedures and protocol became necessary. Not only does the Site Cleanup and Workplace Stewardship Program actively assist in cleanup projects indoors and outdoors, but also it helps organizations create work plans and sustainable housekeeping practices.

In 2017 alone, the program funded 29 cleanup projects at the Laboratory. These projects included moving 250,000 tons of shielding into a newly designated staging area at the Los Alamos Neutron Science Center, draining and recycling 25 broken refrigeration units, and establishing a new laydown yard for the packaging and transportation team's equipment.

One of the largest ongoing cleanup projects has been at Sigma Mesa (Technical Area 60). In 2017, cleanup activities included removing all unneeded material, such as sheet metal, concrete, and wood, and creating a staging area for new dumpsters after three truckloads of broken dumpsters were taken to be recycled.

Another successful 2017 Site Cleanup and Workplace Stewardship project was the Mercury Road Cleanup Project, an area where transportainers, equipment roll-offs, and materials were either stored or abandoned for years. The program first identified the biggest concerns, which included safety and security risks and increasing costs associated with mitigating the area. In addition to effectively cleaning up Mercury Road, the project also utilized solutions to prevent this kind of problem in the future.

Along with being responsible stewards of the environment, two of the most important benefits of the Site Cleanup and Workplace Stewardship Program are improving efficiency and safety at the Laboratory.

For more information, read Chapter 3 in the 2017 ASER.



Preserving yesterday for tomorrow

Cultural Resources staff support the maintenance and preservation of historic sites within the Laboratory.

BY VICTORIA LOVATO In addition to its scientific contributions, Los Alamos National Laboratory offers windows to the past through its various historic and prehistoric sites. As of 2017, 90 percent of Department of Energy land in Los Alamos County has been surveyed for cultural resources, and more than 1,800 prehistoric and historic sites have been identified. Seven new archaeological sites were identified as eligible for the National Register of Historic Places, making a total of 26. Approximately 79 percent of cultural resources located on Laboratory property that originate from the Ancestral Pueblo period, the Homestead period, the Manhattan Project, and the Cold War are eligible for inclusion in the Register and are protected under federal laws.

The Laboratory's Cultural Resources team is responsible for the preservation of these sites and operates in compliance with the National Historic Preservation Act, which requires federal agencies to consider their effects

on historic properties. During the year, staff revised their Cultural Resources Management Plan and worked with the DOE to draft a new Programmatic Agreement. Five Cultural Resources staff members received Wildland Fire Red Card training to support emergency operations in case of a fire emergency.

In 2017, the Cultural Resources team participated in the surveillance, structure evaluations, and archival documentation of the Laboratory's most significant historic and prehistoric properties. For example, the Cultural Resources team partnered with the National Park Service's Vanishing Treasures Program to perform restoration and repair activities at the Pond Cabin, which was constructed in 1914.

Participants from the National Park Service's Vanishing Treasures Program and the Laboratory's Cultural Resources Program Preservation Workshop on the Pond Cabin, which was held in October 2017. (photo credit: National Park Service)





The cabin originally served as an office and library for Ashley Pond, who managed a local ranch. Work on the cabin performed this year included stabilizing the south wall, replacing deteriorated log faces, re-daubing the exterior walls, repairing existing windows, and other related repairs. The team also supported decontamination and decommissioning projects throughout the Laboratory.

The Cultural Resources team continued to work with entities outside of the Laboratory. Cultural Resources staff has partnered with the National

Park Service, Manhattan Project National Historical Park. The Park includes properties at Los Alamos, New Mexico; Oak Ridge, Tennessee; and Hanford, Washington. The Los Alamos site contains seventeen Manhattan Project-era properties located in downtown Los Alamos and within the Laboratory. Eight additional Laboratory structures have been deemed Park eligible.

Staff also worked with the Bradbury Science Museum to catalog historical artifacts and install a history exhibit about the Manhattan Project National Historical Park. The installation was a collaborative effort with students at New Mexico Highlands University.

National Park Service and Laboratory participants work on the Pond Cabin as part of the Cultural Resource Program Preservation Workshop. (photo credit: National Park Service)

Cultural Resources staff conducted annual inspections of the Museum of Indian Arts and Culture in Santa Fe to ensure the proper preservation of artifacts originating from the Laboratory. They also supported monthly technical meetings with the Pueblo de San Ildefonso and Santa Clara Pueblo as well as quarterly meetings with the Pueblo de San Ildefonso, Santa Clara Pueblo, Pueblo de Cochiti, and Pueblo of Jemez to discuss shared interests in environmental and cultural resources.

The Cultural Resources Management team plans to continue surveying the remaining DOE land, completing eligibility evaluations for the Laboratory's historic buildings, and preserving cultural resources in the coming years.

For more information, read Chapters 2 and 3 in the 2017 ASER.



Monitoring endangered and threatened species

Laboratory scientists monitor the presence of species to ensure their safety.

BY MAKENZIE QUINTANA New Mexico is home to 53 endangered or threatened species, both animals and plants. Of those 53, five live either within the boundaries of Los Alamos National Laboratory property or within the adjacent areas. These species include the Mexican spotted owl, Southwestern willow flycatcher, yellow-billed cuckoo, Jemez Mountains salamander, and New Mexico meadow jumping mouse. In adherence with the Endangered Species Act and the Migratory Bird Treaty Act, two federal laws protecting wildlife, the Laboratory monitors these species and their habitats.


The Laboratory keeps a close eye on these endangered and threatened species. For instance, in early spring, biologists visit potential habitat areas of Mexican spotted owls, a threatened species. To survey for owls, biologists play a male's call. If a male owl calls back, it can be assumed that a pair of Mexican spotted owls live there because the male is responding to defend his territory.

If observed, biologists record that the owls are present and make sure they are not disturbed. In 2017, two owl nesting locations were discovered at the Laboratory, and at least one owlet fledged.

Additionally, Laboratory biologists complete Southwestern willow flycatcher surveys starting in mid-May and ending in the middle of July. The procedure is similar to the Mexican spotted owl surveys, but instead of playing the species' call right away, biologists wait until they hear the flycatcher itself. The Southwestern willow flycatcher survey can also be referred to as a presence-absence survey, where biologists listen, record what they hear, and leave. The flycatcher, an endangered species, was not heard in 2017.



Surveys identified two pairs of Mexican spotted owls, such as these.




"The data from presence-absence surveys are used to make critical management decisions for protection of the species and their habitats," explains Laboratory biologist Audrey Smith.

In 2016, biologist Brent Thompson completed surveys for the yellow-billed cuckoo, a threatened species, but no responses were heard and no birds were seen during the surveys. Yellow-billed cuckoos have not been recorded during surveys, but this does not mean they are not present. It may simply mean that the habitat within LANL is not used for nesting by cuckoos.

Monsoons play a crucial role in monitoring the Jemez Mountains salamander, an endangered species. When the habitat is moist enough, the salamanders can be found above ground. When their habitat is dry, salamanders stay below the soil surface. Because of low precipitation and moisture in 2017, surveys were limited. Biologists did not survey for the New

Mexico meadow jumping mouse, an endangered species, because formal survey techniques have not been identified and codified by federal regulators.

For more information, read Chapter 7 in the 2017 ASER.



A Jemez Mountains salamander, an endangered species.



AIR

Quality

Laboratory meets all air quality compliance requirements

Air emissions from the Laboratory deemed safe by regulatory standards.

BY SARA BULTHUIS Air quality monitoring ensures that the Laboratory meets all regulatory standards and allows the air quality team to observe the effects of emissions on the environment. By continually monitoring air emissions, the Laboratory can verify that emissions are below regulatory limits and therefore pose no risk to the public.

"We see no air quality effects from Laboratory operations outside of Los Alamos County," explains Dave Fuehne, a subject matter expert on air emissions at the Laboratory.

The air quality team monitors through five processes: ambient air sampling, exhaust stack sampling, direct-penetrating gamma and neutron radiation monitoring, particulate matter monitoring, and meteorological monitoring.

Los Alamos National Laboratory's ambient air sampling measures the concentration of radionuclides, which are atoms that have excess nuclear energy and are therefore unstable. The team compares the radioactivity in the air to the regulatory limits for members of the public and monitors background concentrations in nearby communities. In 2017, Los Alamos operated 38 monitoring stations to sample radionuclides and found that tritium, americium, plutonium, and uranium were all well below regulatory limits and cobalt, cesium, iodine, sodium, and protactinium were not detected.

Exhaust stack emissions are of particular concern to the air quality monitoring team as these emissions have the potential to release radioactive material into the air. The annual dose to members of the public from air emissions of radionuclides is limited to 10 millirem by the U.S. Environmental Protection Agency (EPA). The Laboratory's air quality

team monitors stack emissions to ensure that the public dose does not exceed this limit.

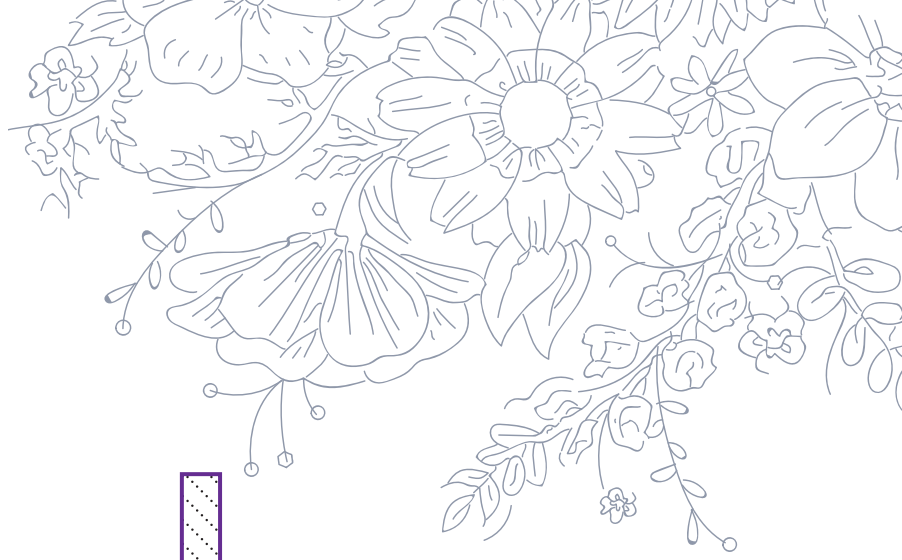
In order to monitor direct-penetrating gamma and neutron radiation, the team deploys dosimeters at every air quality monitoring station and some other locations. In 2017, 80 dosimeters were deployed.

Particulate matter, including dust, smoke, pollen, and water droplets, is monitored at two locations in Los Alamos County. During 2017, the particulate matter concentrations remained well below the EPA standards. The highest concentrations were recorded during the spring from windblown dust and during the summer from distant wildfires.

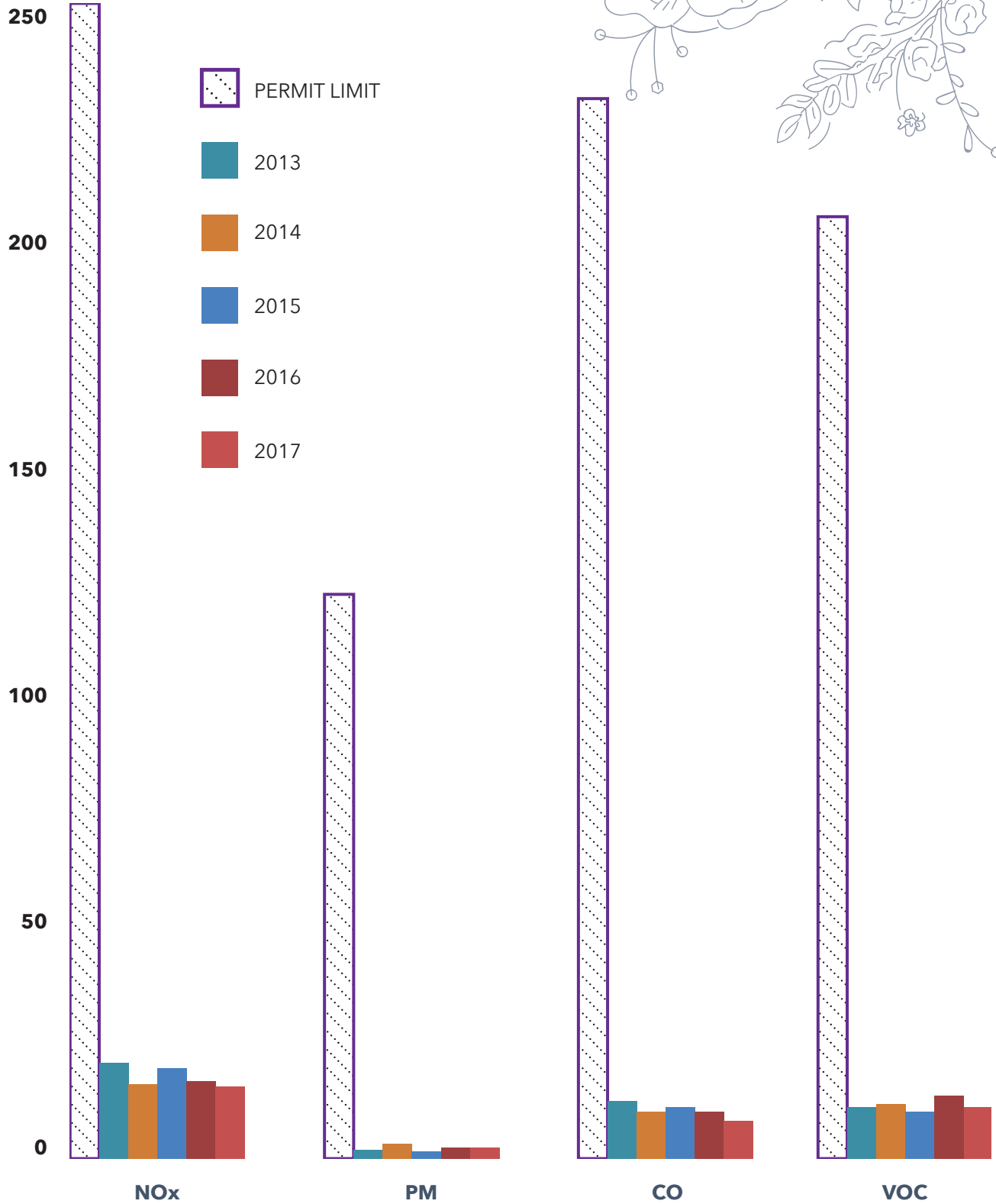
Los Alamos also engages in meteorological monitoring to help with emergency management and response, regulatory compliance, safety analysis, and environmental surveillance. The meteorological program monitors wind speeds and direction, temperature, pressure, relative humidity and dew point, precipitation, cloud cover, and solar and terrestrial radiation.

The air quality monitoring team is committed to continuing to monitor Laboratory air emissions and hopes to reduce future emissions. Regarding air quality, "Los Alamos National Laboratory is probably the most-monitored site in the DOE complex," states Fuehne, "and we plan to maintain these low levels of emissions in the coming years."

For more information, read Chapter 4 in the 2017 ASER.



TONS PER YEAR



Laboratory emissions from 2013 through 2017 are well below permit limits for nitrous oxides (NOx), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOC).

Little rain, lots of shine: Recording meteorological data in Los Alamos County

2017 temperatures followed a warming trend, and precipitation levels stayed below the 30-year average.

BY EMILY RYBARCYK Temperature and precipitation data collection in Los Alamos County dates back to 1910. Today, scientists examine data taken over 30-year timespans (the most recent being 1981–2010) in order to shed light on any trends and to compare averages for one year with larger pools of data. Temperatures in 2017 continued to follow the trend of warmer weather, and precipitation was below the 30-year average.

"Temperatures have been above the 30-year average since 2009 and in 18 of the past 20 years," says David Bruggeman, the Laboratory's meteorologist. "Between 1924 and 2017, the 30-year average temperatures have increased about 1 °F. Precipitation data tend to fluctuate evenly above and below the average with a slightly increasing long-term trend, but since the 1980s, Los Alamos has had a downward trend in precipitation."

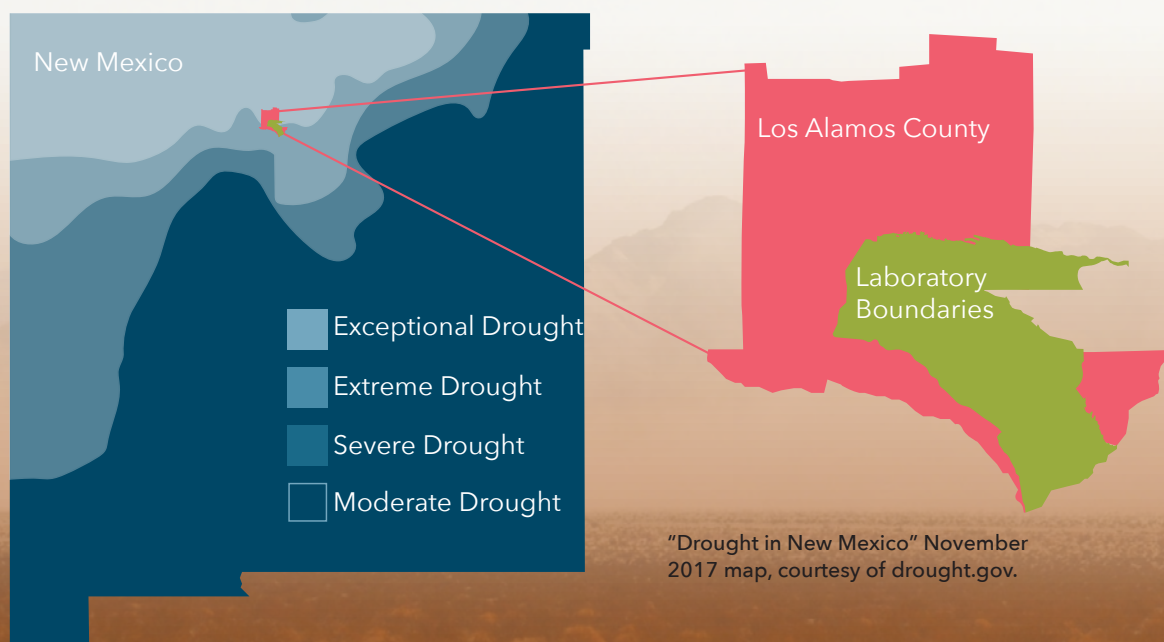
2017 was the second warmest year on record, which was only 0.1 °F away from breaking the record set in 1954.

The winter months of the calendar year and the monsoon season (July, August, and September) bring the majority of the year's precipitation to Los Alamos County.

According to the U.S. Drought Monitor, Los Alamos experienced abnormal drought conditions at the end of the summer in 2017. This year received a total of 17.07 inches of precipitation, lower than the annual average between 1981 and 2010 of 18.97 inches. The lack of snowfall at the end of the year was notable, as only 0.01 inches of snow fell between October and December—the lowest recorded amount of snowfall to start a winter.

When trying to understand annual weather data, it is important to consider the big picture. Decades worth of data and averages help put 2017 into perspective. This year's temperatures continued to follow the warming trend that began in the 2000s, and precipitation was below the 30-year average, which shows a downward trend.

For more information, read Chapter 4 in the 2017 ASER.





WATER *Monitoring*

BY CAMERON TOWNSEND

Groundwater is water that is held underground inside voids within soil and rock.

Where is groundwater?

There are three zones of groundwater beneath the Pajarito Plateau: (a) perched alluvial groundwater, (b) intermediate-depth perched groundwater, and (c) the regional aquifer. Perched alluvial groundwater refers to an area of saturated rocks and sediments which, in Los Alamos, occurs at the base of the canyons. Intermediate-depth perched groundwater is created by water filtering down until it reaches a layer of less permeable rock. The regional aquifer is a deeper area within the rock that yields large amounts of groundwater. The Laboratory and Los Alamos County source their drinking water from the regional aquifer.

Why does the Laboratory monitor groundwater?

The Laboratory monitors groundwater to better understand groundwater sources and movement, to learn the nature and extent of groundwater contamination, and to control contaminant migration. Groundwater monitoring and characterization programs at the Laboratory determine compliance with waste discharge requirements and evaluate any impact of Laboratory activities on groundwater resources.

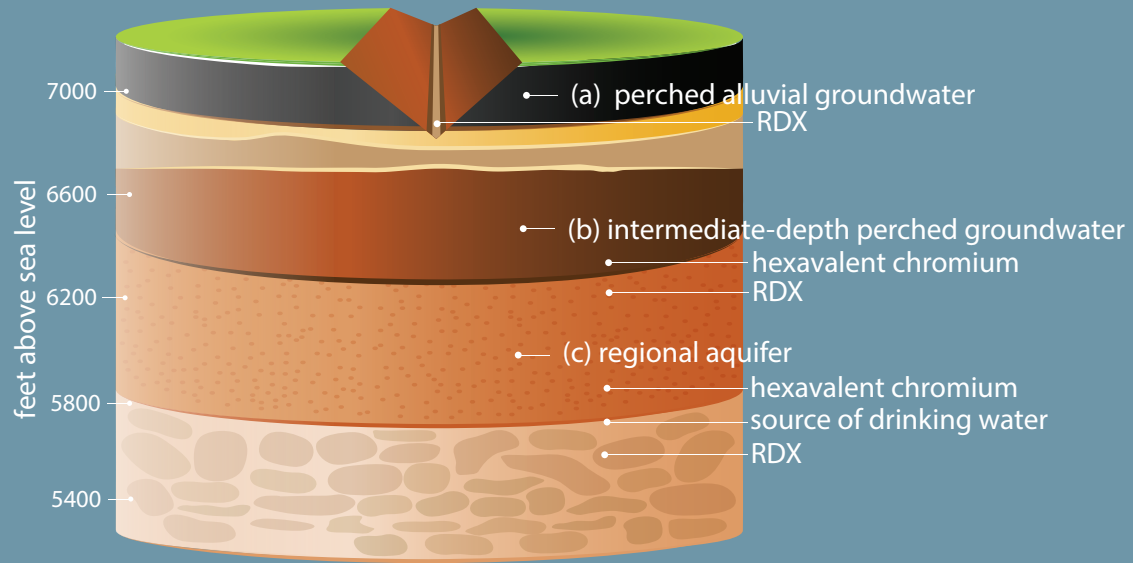
How is monitoring performed?

Each year, the Laboratory collects and analyzes hundreds of groundwater samples from wells. Environmental professionals collect samples representative of the groundwater in each well and ship them offsite to an independent laboratory for analysis. Levels of contaminants are recorded and compared to applicable standards and regulations.

What contaminants are present?

The Laboratory monitors a wide range of organic and inorganic components and radionuclides. The two most notable contaminants are hexavalent chromium, which is present in the intermediate-depth perched groundwater and the regional aquifer (b and c), and RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), which has been detected in all three zones of groundwater (a, b, and c).

What is groundwater?



Relationships between groundwater types, drinking water, and contaminants.

Where do the contaminants come from?

Hexavalent chromium comes from releases of potassium dichromate, which was used from 1956 to 1972 as a corrosion inhibitor in cooling systems at the Laboratory. RDX is an explosive compound whose presence is primarily attributed to water discharges from a high explosives machining facility from 1951 through 1996.

What is being done about contaminants?

Studies to evaluate and characterize groundwater risks are ongoing. In some places, interim measures are being implemented to control contaminant concentrations while the Laboratory explores potential remediation. In late 2017, for instance, groundwater was extracted from the chromium plume in the regional aquifer system, cleaned, and then injected back into the aquifer. Use of this process is expected to increase in 2018.

Is Los Alamos' drinking water safe?

Yes. The Laboratory and Los Alamos County work hard to ensure a safe drinking water supply. In 2017, drinking water from the Los Alamos County water supply system met all federal and state drinking water standards. The Laboratory collected additional samples from 12 Los Alamos County water supply wells and samples from three wells in the City of Santa Fe's Buckman well field. None showed Laboratory-related contaminants above the drinking water standard.

Protecting watershed and surface water quality

Policies, compliance, and infrastructure protect surface water.

BY MARIA MUSGRAVE Given the unique geology of the Pajarito Plateau, there are many watersheds within Los Alamos National Laboratory and Los Alamos County. The Laboratory alone contains all or part of seven primary watersheds, each one draining into the Rio Grande. Therefore, the Laboratory monitors surface water and sediment that may travel during storm runoff events.

As a result of the 1972 Clean Water Act, the Laboratory protects and monitors the watersheds and surface water quality within its current and past footprint. According to Sam Loftin, a member of the Storm Water Permitting and Compliance Team, “The Environmental Protection and Compliance Division manages the Clean Water Act and the Energy Independence and Security Act storm water compliance for the Laboratory. Outfalls, industrial sites, and construction sites all have the potential to release harmful pollutants and sediment into waters of the U.S. Our personnel work with facilities and construction crews to design, implement, and monitor appropriate mitigation activities to protect water quality and keep the Lab in compliance with Environmental Protection Agency regulations.”

There are currently 39 stream gaging stations to automatically sample surface water at the start of storm water runoff events, as well as an additional seven stations that have to be manually sampled. Not all gaging stations or individual permit (IP) stations collect samples each year, depending on where storm water runoff occurs. The Laboratory compares surface water test results to specific Department of Energy biota concentration guides for radioactive materials and to New Mexico surface water quality standards.

When looking at samples, one of the important questions is whether any constituents detected are a result of natural background sources or human activities. There

are several constituents detected in storm water and sediment that have both naturally occurring sources, such as soil and rock, and human-derived sources. For example, arsenic is a compound found in local volcanic formations, but it is also associated with emissions from coal-fired power plants, which the Laboratory historically operated.

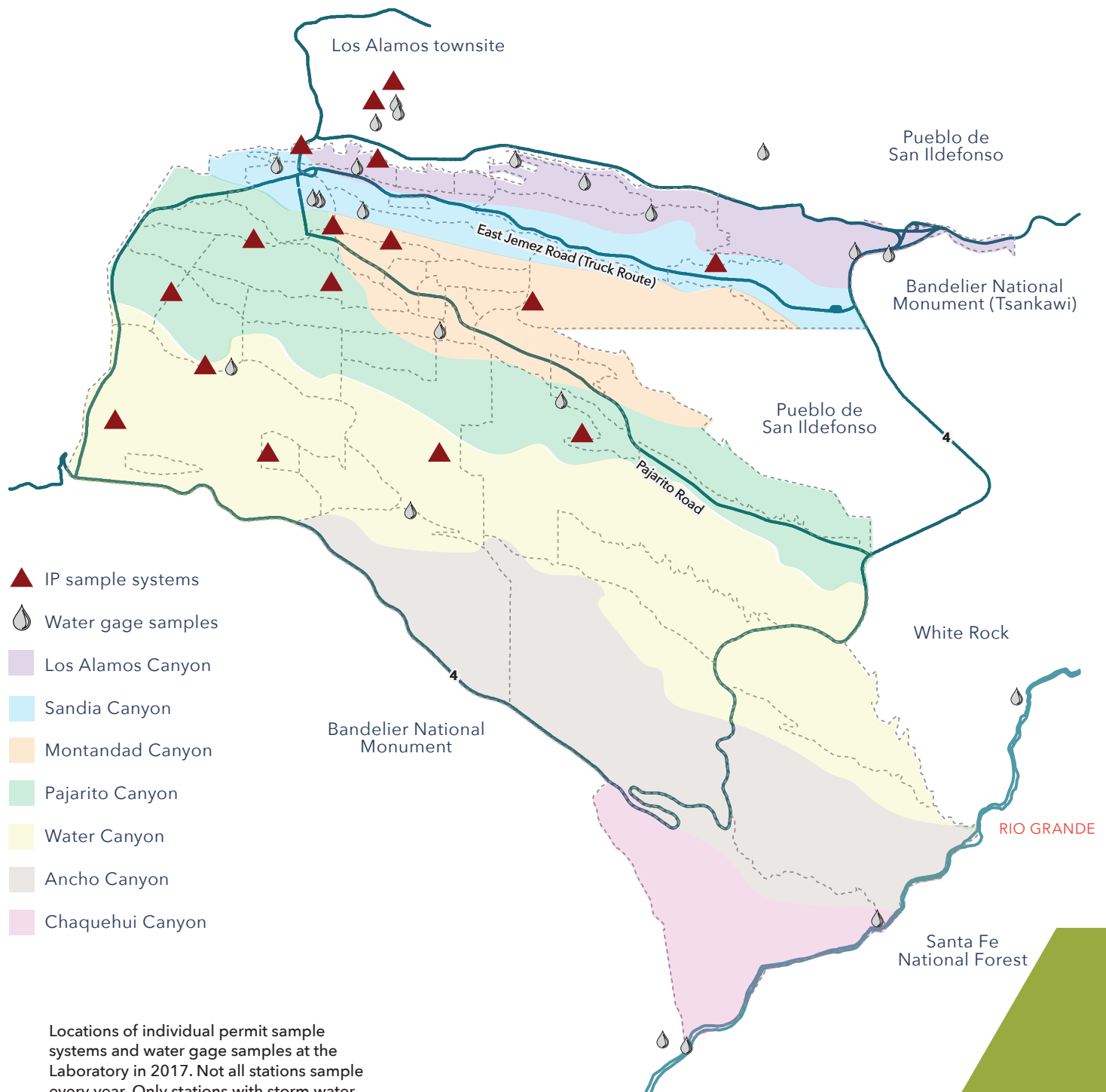
In 2017, tests for radionuclides found that no storm water or base flow samples exceeded aquatic or terrestrial biota concentration guides. There is a high degree of confidence that storm water, base flow, and sediment samples that were above screening levels for either chemicals or radionuclides in 2017 are associated with temporary events that do not significantly affect human or biota health.

“In addition to these ongoing activities, in 2017 we managed or participated in two of the five Supplemental Environmental Protection projects that resulted from a 2014 New Mexico Environment Department Compliance Order. We were able to design and initiate construction of multiple urban and watershed storm water controls and initiate storm water sampling in offsite background and onsite locations,” says Loftin. Continuing to improve infrastructure and environmental controls will help to understand and mitigate surface water concerns in the future.

For more information, read Chapter 6 in the 2017 ASER.

WHAT IS AN OUTFALL?

An outfall is the location where a pipe releases the liquids produced from industrial processes to the environment.





ECOSYSTEM

Health

Studying the local wildlife for conservation

Laboratory teams assess wildlife and ecosystem health by performing monitoring studies.

BY MAKENZIE QUINTANA Los Alamos National Laboratory's biological resources program conducts wildlife monitoring studies to determine if Laboratory operations are affecting wildlife populations, particularly avian populations. Bird monitoring projects include bird banding, avian point-count surveys, and monitoring bird nest boxes both onsite and offsite.

In 2017, Laboratory biologists continued to conduct bird banding in the Sandia Wetlands. This project starts at the beginning of May and goes through the breeding season. From 2014 through 2017, a total of 814 birds representing 61 species were banded, and the most commonly banded bird was the song sparrow.

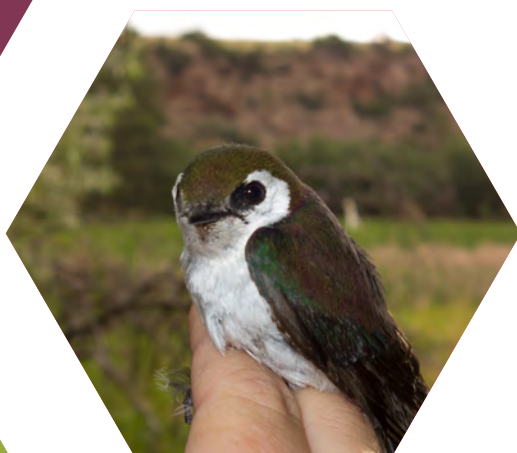
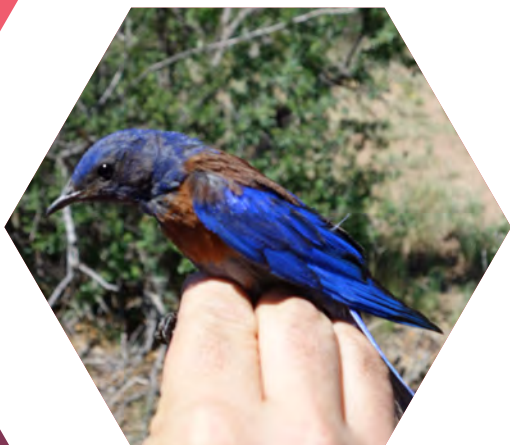
In addition to bird banding, avian point-count surveys were completed in summer 2017. Biologists conducted these surveys to assess whether Laboratory operations are impacting bird species' richness, diversity, abundance, or composition by comparing results of surveys at Laboratory sites with active operations to surveys conducted in similar areas with no Lab activities, also called control sites. A total of 785 birds representing 59 species were recorded during surveys in 2017. Bird species' richness, diversity, and abundance did not differ greatly between operational and control sites.

The avian nest box network monitoring program has been in place for 20 years at the Laboratory. The primary species monitored in the nest boxes are Western bluebirds and ash-throated flycatchers. These birds are common around the Laboratory and use the nest boxes often. Sometimes their eggs do not hatch, and the eggs can be collected and analyzed for contaminants. Results of these analyses indicate that the levels of radionuclides, metals, polychlorinated biphenyls (PCBs), and organochlorine chemicals in the eggs of Western bluebirds and ash-throated flycatchers are not likely to cause adverse effects in breeding bird populations.



Top to bottom:
Western bluebird
Mountain chickadee
Chipping sparrow

Top to bottom:
Common yellowthroat
Western bluebird
Violet-green swallow



Each of these programs helps biologists to better understand the avian populations. The results from these ongoing monitoring projects inform the decision-making processes at the Laboratory. Wildlife biologist Chuck Hathcock states, "You can't assess impacts on a species without long-term monitoring programs."

The Laboratory also collects meat and bone samples from roadkill for analysis. In most cases, the animals are accidentally killed by vehicles and then collected. When this program started in 1970, only mule deer and Rocky Mountain elk were collected. However, the program recently expanded to collect other roadkill such as mountain lions, bobcats, black bears, coyotes, and gray foxes. In 2017, chemical concentrations in deer and elk were similar to or below background concentrations.

For more information, read Chapter 7 in the 2017 ASER.

Working to ensure a healthy aquatic ecosystem

Ongoing monitoring of the ecosystem helps to ensure environmental safety.

BY KYLIE M. GALLEGOS In 2017, scientists at Los Alamos National Laboratory conducted four different sampling projects to monitor aquatic ecosystem health. The purpose of these projects is to determine if Laboratory operations have impacted aquatic ecosystem health. These sampling projects include activities to (1) evaluate chemical concentrations in fish, (2) evaluate chemical concentrations in sediment, (3) conduct a sediment biotoxicity assay, and (4) measure benthic macroinvertebrate communities at locations upstream and downstream of Los Alamos National Laboratory. Results show that Los Alamos National Laboratory is having no adverse effect on the health of aquatic ecosystems around LANL properties.

Los Alamos—meaning that Laboratory activity did not affect nor contribute to these pollutants found in the fish. Sediment samples collected at locations both upstream and downstream of the Laboratory were analyzed for metals, radionuclides, and PCBs. Results showed levels of metals or radionuclides were not higher in downstream sediment compared with upstream sediment. PCBs were not detected in many of the sediment samples, and there was no difference between upstream and downstream locations. By comparing the results of locations around Los Alamos, biologists can be sure that Laboratory activity is not affecting aquatic ecosystem health.



Staff from the Soils, Foodstuffs, and Biota program preparing to collect fish samples from a local reservoir.

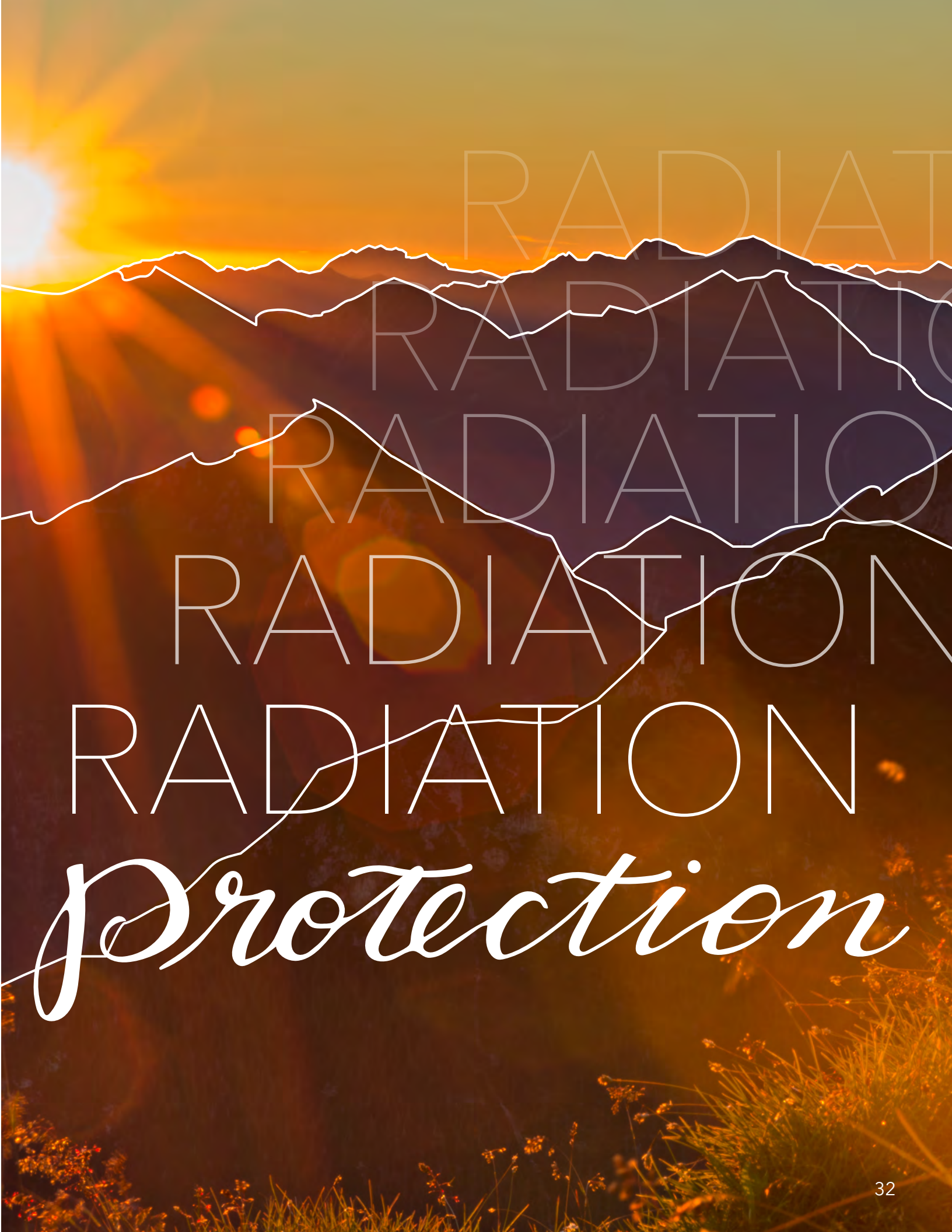
Laboratory scientists conducted fish monitoring at Abiquiu and Cochiti reservoirs and along two reaches of the Rio Grande, both upstream and downstream of its confluence with Los Alamos Canyon. Fish from these sites were tested for metals, radionuclides, and polychlorinated biphenyls (PCBs)—the most common pollutants and the Laboratory's main focus in most environmental testing. Many radionuclides were not detected, although some occur naturally in fish. There was no difference between levels detected in the fish collected upstream and the fish collected downstream. The levels of PCBs and most metals, including mercury, found were similar in fish collected upstream and downstream of Los Alamos. Although some fish exceed the human health consumption level for mercury and PCBs, this occurred in fish collected both upstream and downstream of

Scientists also conducted a toxicity bioassay using the collected sediments to assess the health of organisms inside the ecosystem. This project involved monitoring the growth and survival of two different organisms in river sediment samples over a span of ten days. There was no difference in the percent survival for both organisms from upstream or downstream sediments, which gives further evidence that the Laboratory is having no adverse effect on ecosystem health. One organism, however, experienced reduced growth when exposed to downstream sediment, which could be due to differing variables in the environment or in lab analysis.

Samples of benthic macroinvertebrates, small animals that live among riverbeds, taken from similar locations as the sediment samples were tested for population and diversity measures. Scientists examined characteristics including species richness, abundance, and community composition, as these are clear indicators of a healthy habitat. The results were similar in both upstream and downstream locations.

“Extensive monitoring has allowed us to conclude that Laboratory operations are not affecting aquatic ecosystem health,” says environmental professional Shannon Gaukler. By assessing the health of our ecosystem, the Laboratory can ensure the health of our community and environment for years to come. The Laboratory has been conducting similar tests since the early 1980s and will continue to do so every three years.

For more information, read Chapter 7 in the 2017 ASER.



RADIATION

RADIATION

RADIATION

RADIATION

RADIATION

Protection

Monitoring ionizing radiation

The Laboratory determined the ionizing radiation level resulting from its operations is safe.

BY CARINA ECHAVE Los Alamos National Laboratory monitors how much ionizing radiation (radiation with enough energy to damage or destroy the molecules in a living cell on impact) is produced by Laboratory operations to ensure that emissions are below harmful levels. To quantify risk, the Department of Energy (DOE) requires that each year the Laboratory calculate the maximum dose from ionizing radiation, or simply “radiation,” that would be received by a hypothetical individual who spends 100 percent of the year at the publicly accessible location found to deliver the highest radiation dose from the Laboratory. This hypothetical person is referred to as the maximally exposed individual, or MEI.

Determining the offsite MEI

The publicly accessible, offsite location identified for 2017 was found to be 2101 Trinity Drive in downtown Los Alamos. The MEI dose there was 0.47 millirem. Laboratory radiation at that site was mostly from airborne particles of plutonium, uranium, and tritium, a legacy from work performed nearby during the Manhattan Project and early Cold War years. The soil in the canyon next to this location was being remediated, causing a slight increase of airborne radioactive particles in the area.

Is the MEI safe?

DOE regulations state that total radiation dose to the public must be less than 100 millirem per year. Additionally, the Environmental Protection Agency (EPA) regulation for safe airborne radioactive dose to the public is 10 millirem per year. In comparison, the MEI would have received a total of 0.47 millirem, which is about five percent of the EPA regulatory level and half a percent of the DOE regulatory level.

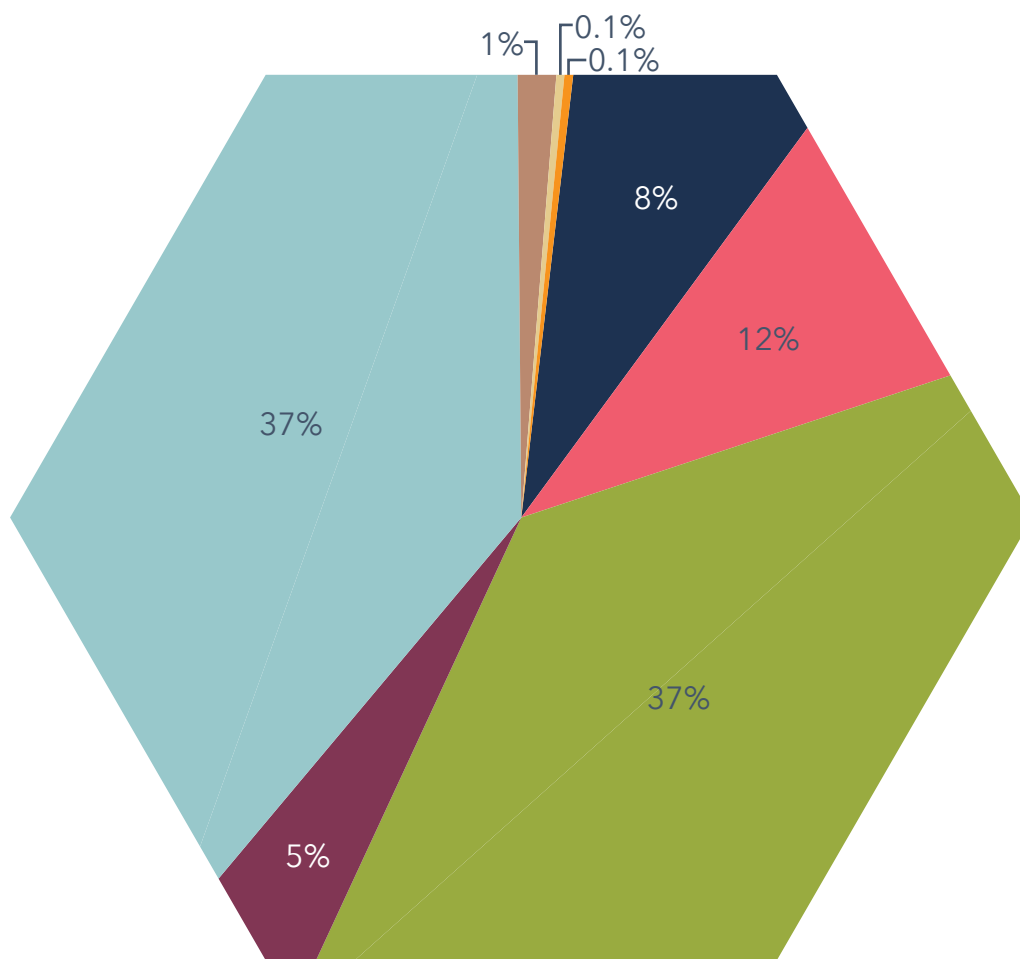
Yes, the MEI is safe

The dose received by the Laboratory’s 2017 offsite MEI was well below both DOE and EPA regulations. **Also, because the MEI is the highest possible exposure to a member of the public and it is safe, it can be concluded that all members of the public are safe.**

To put the MEI’s 0.47 millirem dose in context, humans worldwide are exposed to low levels of ionizing radiation every day, called “background” radiation, and have adapted to it. Total background radiation adds up to about 800 millirem per year. Laboratory health physicist Michael McNaughton explains, “Many cautious and conservative assumptions go into calculating the MEI. The actual dose is much less than 0.1 percent of the dose from background radiation.”

For more information, read Chapter 8 in the 2017 ASER.





Man-made sources:

-  Man-made products
-  Nuclear fallout
-  Laboratory pathways
-  Medical/Dental

Naturally occurring sources:

-  Terrestrial radiation
-  Radon
-  Potassium-40
-  Cosmic radiation

Sources of annual radiation exposure. Most (62%) is from background sources; less than 0.1% is from Laboratory pathways. (Values greater than 1% were rounded.)

DOE Order 458.1, Radiation Protection of the Public and the Environment, requires DOE facilities to protect the public and the environment from undue risk from radiological activities. The order requires DOE facilities to ensure the radiological dose to the public from their activities does not exceed 100 millirem in any given year. It also provides dose limits for wildlife and plants. DOE facilities are directed to keep radiological doses to the public and the environment as low as reasonably achievable and to monitor for routine and non-routine releases of radioactive materials.

CONTRIBUTORS



CAMERON TOWNSEND

Post-master's student for Environmental Protection and Compliance

Townsend, a New Mexico native, earned a Master of Architecture degree from the University of New Mexico, and she is preparing for the Architect Registration Examination. At the Laboratory, Townsend works for the Historic Buildings program where she helps manage Manhattan Project- and Cold War-era historic properties. Townsend's great-grandparents and grandparents worked at the Lab, and by chance, the very first floor plan Townsend analyzed for historic building repairs was drawn by a Lab draftsman—her grandfather.



CARINA ECHAVE

Undergraduate student for Environmental Stewardship

Echave grew up in Los Alamos and attends the University of New Mexico, where she is pursuing a bachelor's degree in chemistry. At the Laboratory, Echave analyzes radium in the Rio Grande to determine how much radium is in fish versus in sediment, among other projects. In the future, Echave plans to continue working at the Laboratory, and she is considering a Ph.D. in chemistry.



KAREN MUSGRAVE

Post-master's student for Environmental Stewardship

Born in Los Alamos, Musgrave completed a bachelor's degree in psychology from the University of Oregon and a master's degree in behavioral ecology from the University of Exeter. After her post-master's position at the Laboratory, Musgrave hopes to use the skills and experience gained in the environmental policy field to become a well-rounded scientist who can advocate for effective and comprehensive environmental policies.



KYLIE GALLEGOS

Undergraduate student for Environmental Stewardship

Gallegos is from El Rito, a small town in Northern New Mexico. Currently, she is a junior at New Mexico State University pursuing a bachelor's degree in agricultural biology. At the Laboratory, she works on the Soil, Foodstuffs, and Biota team. By connecting her education and what she has learned at the Lab, Kylie hopes to become a research biologist specializing in food security and technology.



SARA BULTHUIS

Undergraduate student for Environmental Protection and Compliance

A graduate of Los Alamos High School and a member of the Laboratory's Pollution Prevention team, Bulthuis studies the psychology of behavior change related to pollution prevention and implementing change. She attends the University of Southern California where she is double majoring in psychology and an interdisciplinary major called Law, History, and Culture. Bulthuis' summer work at the Laboratory will help her future career plans in clinical psychology or environmental law.



SIERRA SWEENEY

Undergraduate student for Communication Arts and Services

Sweeney, a Santa Fe native, splits her time between the Southwest and the East Coast, as she is a sophomore pursuing a degree in English with an emphasis on writing at Swarthmore College. At the Laboratory, Sweeney writes and edits for National Security Science magazine and other publications. Sweeney hopes to continue writing and editing for magazines and to one day publish her own fiction books.

LABORATORY STAFF CONTRIBUTORS

MADLINE BOLDING *Copyeditor*
KATHARINE COGGESHALL *Copyeditor*
LESLIE HANSEN *Editor*
MARISA LAMB *Lead Editor*

SHEILA MOLONY *Copyeditor*
DON MONTOYA *Design Advisor*
CARLOS TRUJILLO *Photographer*



EMILEE JONES

Post-baccalaureate student for Communication Arts and Services

Jones completed a bachelor's degree in Graphic Arts from New Mexico State University and studies Art History at Karl-Franzens-Universit t in Graz, Austria. Jones, a New Mexico native, joined the Lab as a graphic designer and hopes to use her travels and diverse cultural experiences to influence her design work.



EMILY RYBARCYK

Undergraduate student for Communication Arts and Services

A Los Alamos local, Rybarcyk began working at the Lab as a writer-editor in June 2017. She is double majoring in creative writing and psychology at the University of Arizona in Tucson. The Lab has given her a chance to write and edit in a professional setting, and she desires to continue doing similar work as a long-term career.



MAKENZIE QUINTANA

High school student for Environmental Stewardship

Quintana grew up in Northern New Mexico and lives in Pojoaque. She is a senior at Pojoaque Valley High School. New to the Laboratory, Quintana works on the Biological Resources program and enjoys learning something new every day, from animals' species codes used in data entry to survey techniques used in the field.

Following high school, she wishes to attend New Mexico State University and study wildlife science.



MARIA MUSGRAVE

Master's student for Environmental Stewardship

Musgrave studied Environmental Science at the University of Redlands in California, and during college, she interned in the Laboratory's Biological Resources Management program. After completing a post-baccalaureate position, she began a master's degree in Conservation Leadership from Colorado State University. Upon graduating, Musgrave, who grew up in Los Alamos, hopes to combine conservation and education as she continues to live and work in Northern New Mexico.



SYDNE ASHFORD

Undergraduate student for Environmental Stewardship

Ashford, a recent graduate of Los Alamos High School, works in the Pollution Prevention Program, where she researches chemical use at the Laboratory. She attends Wellesley College and is pursuing a degree in chemistry for a future in medical sciences. Ashford hopes to return to Pollution Prevention to continue her education in chemistry and data analysis.



VICTORIA LOVATO

Undergraduate student for Cultural Resources Management

Lovato is the daughter of Nick and Rebecca Lovato of Ojo Caliente, New Mexico. A senior at New Mexico State University, Lovato studies history and Spanish. As part of the Laboratory's Historic Building team, Lovato worked on interpretive panels that highlight the experiences and contributions of local Native Americans and Hispanics in relation to the Laboratory. After graduating, Lovato aspires to attend law school and become an attorney.

